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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,644	08/19/2003	Roberta J. Cochrane	ARC920030030US1	5236
29154	7590	10/29/2007		
FREDERICK W. GIBB, III Gibb & Rahman, LLC 2568-A RIVA ROAD SUITE 304 ANNAPOLIS, MD 21401			EXAMINER SAEED, USMAAN	
			ART UNIT 2166	PAPER NUMBER
			MAIL DATE 10/29/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/643,644

Applicant(s)

COCHRANE ET AL.

Examiner

Usmaan Saeed

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2166

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 August 2007.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-4, 8-11, 15-17 and 21-24 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-4, 8-11, 15-17 and 21-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

***Response to Amendment***

1. Receipt of Applicant's Amendment, filed 08/21/2007 is acknowledged.

Claims 1, 8, 15, and 21 have been amended.

***Claim Rejections - 35 USC § 101***

2. In view of the amendments filed on 08/21/2007, the 101 rejections have been withdrawn.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-4, 8-11, 15-17, and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lehner et al.** (**Lehner** hereinafter) (NPL "Maintenance of Cube Automatic Summary Tables" ACM 200 PG's 512-513) in view of **Mumick et al.** (**Mumick** hereinafter) (U.S. Patent No. 6,484,159).

With respect to claim 1, **Lehner teaches a method of incrementally maintaining algebraic functions in automatic summary tables (ASTs) of at least one relational database, said method comprising:**

**“associating a work area with each algebraic function in each AST”** as the set of aggregate functions is restricted to SUM and COUNT. Every AST must have a COUNT(\*) column. If a column X is nullable and the AST computes SUM(X), a named COUNT(X) column is also required (**Lehner 2. Definition of AST's, Pg 512**).

**“populating variables within each work area for each algebraic function when each AST is created and when each AST is updated”** as the set of aggregate functions is restricted to SUM and COUNT. Every AST must have a COUNT(\*) column. If a column X is nullable and the AST computes SUM(X), a named COUNT(X) column is also required (**Lehner 2. Definition of AST's Pg 512**). *STEP II: Aggregating the Delta.* In this step, the delta stream is aggregated. If the underlying modification is an insertion or deletion, then the grouping specification contains all the combinations specified by the AST. For ASTs with complex grouping expressions, e.g. CUBE(), this step results in a complete delta cube with 'higher' delta aggregate values for all original delta changes. If the modification is an update, then the grouping specification contains all the combinations specified by the AST extended with the tag column. For updates, the resulting aggregate values are multiplied with the value of the tag, and a second delta aggregation step consisting of a simple aggregation over all grouping columns plus all grouping function columns is added to eliminate the tag column and compute the net

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aggregate changes (i.e. delta value) from the old to the new base table values (**Lehner**

3. Incremental Maintenance, Pg 513).

**“maintaining each work area by adding and subtracting to and from associated variables of each work area when associated data changes in said relational database”** as the set of aggregate functions is restricted to SUM and COUNT. Every AST must have a COUNT(\*) column. If a column X is nullable and the AST computes SUM(X), a named COUNT(X) column is also required (**Lehner 2. Definition of AST's Pg 512).** *STEP II: Aggregating the Delta.* In this step, the delta stream is aggregated. If the underlying modification is an insertion or deletion, then the grouping specification contains all the combinations specified by the AST. For ASTs with complex grouping expressions, e.g. CUBE(), this step results in a complete delta cube with 'higher' delta aggregate values for all original delta changes. If the modification is an update, then the grouping specification contains all the combinations specified by the AST extended with the tag column. For updates, the resulting aggregate values are multiplied with the value of the tag, and a second delta aggregation step consisting of a simple aggregation over all grouping columns plus all grouping function columns is added to eliminate the tag column and compute the net aggregate changes (i.e. delta value) from the old to the new base table values (**Lehner 3. Incremental Maintenance, Pg 513).**

**“computing each algebraic function”** STEP IV: Aggregate Value

Compensation. When a delta group has a corresponding group in the AST, then the new value for the group must be computed based on the value of the delta and the

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current value of the group. Since the AVG aggregation function can be mapped to an equivalent SUM/COUNT expression, '+' is the only aggregation value compensation function, required to support SUM, COUNT, and AVG (**Lehner** 3. Incremental Maintenance, Pg 513).

**“reporting said algebraic function to a user”** as transparently rerouting user queries originally referencing base tables to those views [4], and (c) maintaining ASTs, i.e. synchronizing them with the base tables (**Lehner** 1. Introduction).

**Lehner** teaches the elements of claim 1 as noted above but does not explicitly disclose **“Multiple algebraic functions.”**

However, **Mumick** teaches **“Multiple algebraic functions”** as simple algebraic expressions for maintenance of view expressions involving outerjoin operators (**Mumick** Col 17, Lines 29-31).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of the cited references because **Mumick’s** teachings would have allowed **Lehner** to provide significantly faster modification of the operators than the iterative algorithms by implementing higher level change table to the materialized view using a refresh operation.

With respect to claims 2 and 3, **Lehner** teaches **“wherein said multiple algebraic function share the same work area when one of: said algebraic function match exactly; said algebraic function match partially; and said algebraic functions have an intersection”** as STEP III: Pairing the Delta to the AST. After

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aggregation, the rows in the delta are paired with the current content of the AST using a left outer-join (the delta goes left) over the grouping and grouping function columns of the AST. Thus a delta group either matches with a single group of the summary table or no group at all. Delta groups that have matches cause the corresponding row in the AST to be modified; those that do not have matches are later added to the AST. STEP IV: Aggregate Value Compensation. When a delta group has a corresponding group in the AST, then the new value for the group must be computed based on the value of the delta and the current value of the group. Since the AVG aggregation function can be mapped to an equivalent SUM/COUNT expression, '+' is the only aggregation value compensation function, required to support SUM, COUNT, and AVG (**Lehner** 3. Incremental Maintenance, Pg 513).

**Lehner** teaches the element of claims 2 and 3 but does not explicitly disclose, **“wherein multiple algebraic functions share the same work area.”**

However, **Mumick** discloses, **“wherein multiple algebraic functions share the same work area”** as simple algebraic expressions for maintenance of view expressions involving outerjoin operators (**Mumick** Col 17, Lines 29-31). An aggregate function is defined as distributive if it can be computed by partitioning the input parameters into disjoint sets of parameters, aggregating each set individually, then further aggregating the (partial) results from each set into the final result (**Mumick** Col 12, Lines 55-59).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching of the cited references because **Mumick's** teachings would have allowed **Lehner** to provide significantly faster modification of the

operators than the iterative algorithms by implementing higher level change table to the materialized view using a refresh operation.

With respect to claim 4, **Lehner** teaches “**wherein said computing process comprises recomputing said algebraic function after one or more of said variables have changed**” as the advantage of an incremental maintenance strategy is that the changes in the AST are computed directly from the changes of the base table. Consider an AST containing a join over several tables. Incremental maintenance can compute the changes to the AST using the joins of only the changes of the base tables (deltas) with all other tables of the AST definition (**Lehner** 3.Incremental Maintenance, Pg 512). If an AST is declared 'REFRESH DEFERRED' then no base table changes are propagated when a base table is modified. In lieu of sophisticated algorithms [3], refreshing a deferred AST implies full recomputation (**Lehner** 2.Definition of AST's, Pg 512).

**Mumick** further teaches in order to keep the views in the data warehouse up to date, it is necessary to maintain the materialized views in response to the changes at the sources. The view can be either recomputed from scratch, or incrementally maintained by propagating the base data changes onto the view so that the view reflects the changes (**Mumick** Col 1, Lines 15-20).

Claims 8-11, 15-17, and 21-24 are same as claims 1-4 and are rejected for the same reasons as applied herein above.



***Response to Arguments***

4. Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

See above rejections for all the arguments.

***Contact Information***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Usmaan Saeed whose telephone number is (571)272-4046. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hosain Alam can be reached on (571)272-3978. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Usmaan Saeed


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Patent Examiner  
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Leslie Wong  
Primary Examiner

US  
October 19, 2007

  
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SUPERVISORY PATENT EXAMINER